SOCIO-ECONOMIC STUDY OF THE PROPOSED SHELL OIL COMPANY PEARL MINE

INTERIM REPORT VOLUME 4

Population

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This report is in the preliminary Review Draft stage. As such it represents neither the final judgement nor the official position of the Meadowlark Group or the State of Montana.

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Between 1960 & 1970, the percent of urban dewllers in places over 25,000 in Wyoming declined from 44.0% to 39.9%. This occurred in spite of a 0.7% increase statewide. (The reason for this is that the places undergoing greatest growth were between 2,500 & 25,000. This category increased from 56.0% of the urban dwellers to 60.1% of them.) This means the growth was proportionally considerably greater in small towns than in larger towns (city). Meanwhile, rural populations declined from 143,000 to 131,000, a net statewide decrease of 7.9%.

Overall, then, the state of Wyoming gained approximately 2,000 residents, growing to 332,416 from 330,066 during the period, the lowest net gain the state had experienced since 1900. The overall growth from 1900 to 1970 was 280%. Greatest percentage growth occurred during the first two decades of this century although numeric growth remained approximately equal through most decades until 1960 at which time growth markedly slowed. Since 1970 the trends indicate a rather rapid increase in population growth in the study area. Sheridan County grew an estimated 8.1 percent while Big Horn County increased 4.4 percent. The city of Sheridan had 10,856 persons in 1970, a decrease of 795 persons (6.8%) from its 11,651 in 1960. With the exception of the 1920's Sheridan has shown a consistent increase in population since 1900, as illustrated in Table D-1.

TABLE D-1: POPULATION, 1900-1976, SHERIDAN CITY, SHERIDAN COUNTY, STATE OF WYOMING.

	SHERIDAN CITY	%	COUNTY	%	WYOMING STATE	%
1976	13,200	12.1	20,800	17.0		
1970	10,856	-6.8	17,852	-9.4	332,416	0.7
1960	11,651	1.3	18,989	-9.4	330,066	13.6
1950	11,500	9.2	20,185	9.5	290,529	15.9
1940	10,529	23.3	19,255	11.4	250,742	11.2
1930	8,536	-7.0	16,875	-10.8	225,565	16.0
1920	9,175	9.1	18,182	11.1	194,402	33.2
1910	8,408	439.3	16,324	31.9	145,965	57.7
1900	1,559	-----	5,122	-----	92,531	47.9

The 1960-1970 loss occurred in spite of annexation which increased the city population by 423 persons. There was a marked reduction in the pre-school and early school age children, implying: a) maturation of children born by 1960; and b) no further immigration of adults in their child formation years. Although decreases typified most age-groups, net increases occurred among persons over 45 years of age, especially among persons 60 or older, showing the effect of maturation.

Big Horn County also has shown some increase (4.4%) during the last one-half decade although the extent has been considerably less than experienced by Wyoming (8.0%) (See Appendix). However, the sustained growth since 1960 has been subject to less fluctuation in Big Horn County and Montana than in the Wyoming counterparts. Whereas Sheridan had lost population from 1960-1970 and Wyoming had increased by less than 1%, Big Horn County and Montana had increased 0.5% and 2.9%, respectively, and the Decker-Birney census division of Montana had increased 2.4%

Population Structure

The study area exhibits considerable variation in the composition of its population. Big Horn County has a relatively young population with a relatively high percentage of 39.8% American Indians, the only sizable ethnic or social minority in the area. Sheridan County has a very different profile, having less than 1 percent minority persons and having relatively high proportions of children and adults of late middle age and old age. Both counties have approximately the same number of males and females. The 1970 household units also show marked differences between Big Horn and Sheridan Counties. Whereas Sheridan has a relatively small 2.78 persons per household, Big Horn has a rather high 3.74 average (See Appendix).

Vital Rates

Differences in population structure are further exhibited in the respective vital rates of Big Horn and Sheridan Counties. Sheridan County has relatively low fertility, due largely to its bimodal age structure. That is, lacking a high proportion of persons in their child bearing years, the crude birth rate is low in spite of relatively high age-specific fertility among the child bearing young adults. Big Horn County has 22 births per one thousand residents whereas Sheridan County had 13.7 per thousand. (See Appendix). In both cases fertility is slightly reduced from 1970 levels.

Examination of mortality rates shows an inverse of the fertility relationship. That is, mortality in Big Horn County is considerably lower (10.2 deaths/thousand residents) than in Sheridan County (12.1/1000). Such a difference again is due to the age structures which show a high proportion of older, hence shorter life expectancy, persons in Sheridan County. However, a noticeable convergence of mortality rates has occurred between the counties since 1970 when Big Horn had a 10.2 crude death rate while Sheridan's was 15.2. Presumably the convergence primarily has been due to the influx of younger population into

Sheridan County following recent coal related development. Finally, the marital characteristics have been rather similar in the study areas. In 1970 Big Horn and Sheridan Counties respectively had 63.8% and 62.5% of their populations over 13 years old married. These closely resemble the comparable Montana and Wyoming figures of 63.4% and 66.2%.

TABLE D-2: VITAL RATES OF IMPACTED AREAS, 1970-1975

	1970-1975 NUMBER BIRTHS	1970 CRUDE BIRTH RATE [3]	1975 CRUDE BIRTH RATE [3]	NUMBER OF DEATHS	1970 CRUDE DEATH RATE	1975 CRUDE DEATH RATE	NATURAL NUMBER	INCREASE 1975 [4] PER CENT
Big Horn County	1,354 [1]	24.8	20.7	598	9.6	8.9	756	7.5
Sheridan County	1,532 [2]	13.4	14.3	1,241	9	6.9	291	1.6
Montana	72,048 [1]	18.2	16.1	40,313	9.4	8.7	31,735	9.9
Wyoming	31,730 [2]	19.7	18.8	15,316	8.8	8.3	16,369	4.9

1. Montana Bureau of Records and Statistics 1975 Montana Vital Statistics State Department of Health and Environmental Sciences, Helena, Montana, 1975.

2. Wyoming Division of Health and Medical Services Wyoming Vital Statistic 1971-1975. Cheyenne, June 1973

3. Rates are calculated from the number of events per 1000 persons in population.

4. Excess of Births over Deaths. Percent calculations - utilize 1970 populations as a base.

TABLE D-3: MARITAL STATUS AND HOUSEHOLD CHARACTERISTICS OF IMPACTED AREAS, 1970

	MARRIED PERSONS (14 YEARS AND OLDER)	PERCENT MARRIED	NUMBER OF HOUSEHOLDS	PERSONS PER HOUSEHOLD	ESTIMATED NUMBER OF CHILDREN PER HOUSEHOLD [3]
Big Horn County[1]	14,266	63.8	2,664	3.74	2.07
Sheridan County[2]	8,712	62.5	6,189	2.78	1.34
Montana	318,460	63.4	217,304	3.10	NA
Wyoming	159,504	66.2	104,600	3.09	NA

1. U. S. Bureau of the Census, U. S. Census of the Population: 1970 - Volume 1, Part 28, Montana - U. S. Government Printing Office, Washington, D. C.: 1970

2. U. S. Bureau of the Census, U. S. Census of the Population: 1970 Characteristics of the Population - Volume 1, Part 52, Wyoming U. S. Government Printing Office, Washington, D. C.; 1970

3. U. S. Department of the Interior, Geological Survey - Final Environmental Impact Statement East Decker and North Extension Mines Decker Coal Company. Big Horn County, Montana Volume II, Appendix Montana Department of State Lands, Helena - No date provided

TABLE D-4: SEX AND RACE CHARACTERISTICS OF IMPACTED AREAS, 1970

	1970 SEX RATIO	1970 WHITE POPULATION(%)		1970 ESTIMATED INDIAN POPULATION(%)		1970 TOTAL
Big Horn County [1]	98	6,018	(59.8)	3,917	(38.9)	10,057
Sheridan County [2]	99	17,662	(98.9)	100	(.06)	17,853
Montana	100	663,043	(95.5)	27,130	(3.9)	694,409
Wyoming	101	323,024	(97.2)	4,980	(1.5)	332,416

1. U. S. Bureau of the Census U. S. Census of the Population: 1970 Characteristics of Population Volume 1, Part 28, Montana U. S. Government Printing Office, Washington D. C.; 1970

2. U. S. Bureau of the Census, U. S. Census of the Population: 1970 Characteristics of Population Volume 1, Part 52, Wyoming U. S. Government Printing Office, Washington D. C.; 1970

3. U. S. Department of Interior, Geological Survey Final Environmental Impace Statement -- East Decker and North Extension Mines Decker Coal Company - Big Horn County, Montana Volume II, Appendix Montana Department of State Lands, Helena, No date provided

Population projection models tend to make future population change appear to be more orderly and less fluctuating than is in fact the reality. This is particularly evident in cases, such as those reported here, which involve relatively small population in a statistical sense and where actual development occurs in conjunction with specific decisions which effect hundreds of persons within short time periods. Consequently, the general trends reported in conjunction with models should be understood rather than specific figures reported for any particular time being expected. Finally, it should be understood that each assumption governing population growth may vary from actual future occurrences. The mortality and, especially, fertility rates for local and in-migratory persons may differ and may vary throughout time. The number of children and other dependents brought by primary and secondary workers may vary, and the number of secondary workers generated per primary worker job also may vary. On the other hand, even though projection models are open to errors from this variety of sources, they still provide a desireable manner of looking toward the potential future. They provide a consistent set of assumptions against which the future may be evaluated. These assumptions govern how the major dynamic processes operate. When the model appears to be inaccurate, one need only to look to the loci of errors in order to understand error sources and, consequently, to correct for these. Perhaps most important, models permit a wide variety of data to be examined in a reliable and comparable manner. Because of this the relative effects of each growth scenario may be examined in juxtaposition with all others thereby providing relative rather than absolute descriptions of change.

Population Projection
Developmental Assumptions

1. The development of the Pearl mine in conjunction with other scenarios of coal development will provide the sole reason for primary and secondary population increases.
2. A composite of births and deaths to indigenous and in-migrating persons are the variables involved in projecting populations

Considered by themselves, population figures mean rather little. They must be put into context in order to acquire meaning. This section will describe the potential population increase from the Pearl mine alone and in the context of the other potential developments described as Scenarios I, II, III. Population increases will be described under two major possibilities. First, discussion will center around what might occur if all population increases are experienced in Sheridan County. Second, the impacts of the population migrating equally to Big Horn County and to Sheridan County will be considered. Further, in the Wyoming context for which existing municipalities constitute probable loci of residence, examination of potential population growth will be considered.

The impacts of Pearl and other proposed mines upon the population of Sheridan County, although centered in the city of Sheridan, also will be experienced in other municipalities. These communities, especially Ranchester and Dayton currently have few available residences to attract residents. If developments were forthcoming, however, residents probably would be rapidly attracted to them. Given their relatively small size, the potential proportionate increase in population indeed might be great. For example, Ranchester increased 101% between 1970 and 1976, while Dayton increased 72% during the same period. However, rather than give precise estimates, which are impossible given the unknowns surrounding future residential developments, let the reader

imagine what would happen if Ranchester received only 5% of the impacts of the Pearl mine, with Scenarios I, II, and III, respectively for 1980, 1990, and 2000.

	1976	1980	1990	2000
Pearl Mine	420[1]	457	462	465
Scenario I & Pearl Mine	420	527	581	591
Scenario I,II, & Pearl Mine	420	535	735	761
Scenarios I,II,III & Pearl Mine	420	566	1011	1065

The projected population of Ranchester, Wyoming, if 5% of populations from projected developments.

[1]Bernie Spielman, Population Update from Sheridan County Wyoming, Sheridan Area Planning Agency, Sheridan, Wyoming, May, 1977.

If Ranchester were to have residential and service facilities for one-quarter of the generated population, then the population increases might well be five times the magnitude of the above figures. The reader is invited to project other figures for municipalities in the study area keeping in mind the numbers represent persons of particular age characteristics, which require schools, fire and police protection, medical care and a wide variety of other public as well as private sector services.

The most probable locus of growth of population from coal development along the Montana- Wyoming border is the city of Sheridan. Again acknowledging that future residential development is largely unknown, if 75% of the population from potential coal development resided in Sheridan city, the population figures might resemble those in following table.

Population of the city of Sheridan, given 75% of the projected impact population, resided there during 1980, 1990, and 2000.

	1976	1980	1990	2000
Pearl Mine	13,200	13,761	13,825	13,871
Scenario I & Pearl	13,200	14,805	15,616	15,764
Scenarios I,II, & Pearl	13,200	14,923	17,588	18,320
Scenarios I,II,III & Pearl	13,200	15,392	22,070	22,878

These and the preceding figures are less intended to provide precise estimates of what the populations in Ranchester and Sheridan may be than to illustrate two other important matters. First, they demonstrate that the potential impact of the combined developments outlined as Scenarios I,II,and III are considerable. Second, they indicate that of itself the population impact of only the Pearl mine may be rather moderate when considered by itself and certainly modest when considered in conjunction with other potential developments.

Racial changes

It is unlikely that the stream of migrants to the impact area will contain a higher proportion of racial minority persons than currently exist in Sheridan County; that is, roughly one person per hundred residents. This small in-migration can be anticipated since labor for construction and plant operations in this region is largely performed by white persons. While this undoubtedly is a consequence of some de facto segregation, it further reflects the lack of job skills among minority persons as well as a greater reticence for persons to migrate to areas which have low densities of persons of their racial characteristics. Given these probable occurrences the potential effects of coal development in the forms of the Pearl mine and the described scenarios also vary considerably between Sheridan and Big Horn Counties.

If population growth is limited to Sheridan County, then the current proportion of minority racial persons should remain relatively constant. Pearl Mine could be expected to increase the number of minority persons by seven or eight persons during its operation period. The combined effects of the highest growth assumption including all scenarios and Pearl Mine might be expected to attract perhaps one hundred thirty minority persons by the turn of the century. And, if Sheridan County receives only one-half of the potential growth, then roughly half these numbers might be anticipated from future development unless minority persons favor residence in the already established municipalities, especially the city of Sheridan. These relationships are illustrated in Table___. Of course if specific social or political factors altered either the attractiveness of those jobs to the area or altered the abilities of minority persons to qualify for such jobs, then the proportional minority representation might be higher.

The effects of the type of migration stream described above are potentially quite difficult for Big Horn County. Of course, if growth is restricted to Sheridan County, then the racial composition of Big Horn County is unlikely to be affected by this external force. As mentioned above, even if Big Horn County is the host to one-half of the impacting population, minority members migrating to the area might prefer residence in the city of Sheridan. Nevertheless, the potential impact of large numbers of in-migrants to Big Horn County could be rather profound. Rather then experiencing an increase in the number of minority persons, it might well experience a decrease because of the already sizable minority residing there. As Table ___ indicates, an increasing population of predominately white persons could reduce the proportion of the American Indian population a considerable amount. However, if current fertility differentials continue into the next two decades much of the proportionate decline of the Big Horn County American Indian population would be moderated.

Residential Choices of Migrants	1976	1980		1999		2000	
		numeric minority increase	estimated % minority	numeric minority increase	estimated % minority	numeric minority increase	estimated % minority
	7		1%	8	1%	9	1%
100% all Scenarios		29	1%	118	1%	129	1%
Pearl		4	1%	4	1%	5	1%
50% all Scenarios		15	1%	59	1%	65	1%
Big Horn		4		4		5	
50% all Scenarios		15		59		65	
Pearl		0		0		0	
0% all Scenarios		0		0		0	

Changes in Size Composition

Potential changes in age composition in the study area could be among the more dynamic and important demographic changes resulting from coal development. Without migration population structures have their own internal dynamics as persons are born, mature and die. With migration this dynamic becomes increasingly modified. The age structure of Shridan County has a relatively small working age sector, especially in the ages 20-35. This indicates out-migration has favored this category. These persons are precisely the age type, along with their progeny, who will be attracted to the impact area for employment. Since development will occur throughout an extended time period, new working age persons continually may be drawn to the area while similar persons who otherwise would have left the area in search of opportunities probably will remain.

If Sheridan County receives the entire influx of population from Pearl mine the numbers of persons will constitute the primary change in population. The net changes for any five year age grouping probably will be less than 1% For example, as Table indicates, the

TABLE : Projected Percentages of Women in Selected Age Categories in Sheridan County if Pearl Mine is Developed or is Not Developed, 1980 and 2000.

Ages	1975	1980			2000		
		Without Pearl	With Every thing	With Pearl	Without Pearl	With Pearl	With Everything
Under 10	5.93	7.21	7.12	7.27	7.46	7.46	7.72
10-15	7.4	8.73	8.62	8.70	7.50	7.47	7.07
25-30	4.48	4.45	4.52	4.41	7.67	7.67	7.47
40-45	6.63	5.44	5.67	5.34	6.08	6.01	5.59
60-65	4.80	4.96	4.58	5.12	4.20	4.25	4.87
85 +	1.38	1.48	1.37	1.52	3.00	2.03	1.38

presence of Pearl mine or the full development scenario for that matter would contribute little change to the female population age structure of Sheridan County. By 2000 there is a promise of a higher percentage of small children, young adults, and the aged persons, but these changes probably will occur even if Pearl mine is not developed. Conversely, by 2000 slight percentage reductions may be expected for school age, latter middle age and old age. If one-half of the population in migration from mine occurs, then the alternations of age structure probably would be even slightly less.

The age structure of Big Horn county is quite another matter. Of course if all immigration occurs in Sheridan County, then no effect on the age structure should be noted. However, if fifty percent of the new Pearl employees resided in Big Horn county, the age structure would be markedly altered.

APPENDIX FOR POPULATION

The population projections reported in this impact statement differ somewhat from those generally provided for either conventional demographic projections or conventional impact statements. Conventional projections of population usually manipulate variables within the statistical model so that a range of projections are created based on differing assumptions related to levels of fertility, mortality and migration. When applied to population growth which might result from the development proposed in the impact statement, such projective techniques have advantages under conditions of potentially wide variation in fertility and mortality. They also have advantages when the impacted area appears to be relatively stable except for the proposed development. However, since neither of these conditions probably apply for Sheridan County an alternative method of projecting impact has been utilized in this research.

The assumption made for the purposes of this report is that the impact of the Pearl Mine should be conceived of as more than an absolute effect upon an otherwise unchanging environment. Rather, the relative effects of the Pearl Mine population increase gain more meaning when considered in terms of growth from other potential developments. Projection efforts, then, have been directed toward understanding the effects of the Pearl Mine in conjunction with the possible dynamics of externally induced change in the form of coal development more than in the examination of the possible variations in the internal demographic processes such as varying vital rates. Consequently, the fertility and mortality rates of 1975 are projected into the future. Advantages of this technique follow. First that the Pearl Mine impacts will be placed into a more valid perspective than if considered in isolation from other development. Second, this technique focuses upon the variable with the greatest potential modification of population structure and immigration through coal development. This is not intended to imply that vital rates are unimportant. In fact, the component projection model utilized considers them in considerable detail. Nonetheless, the primary initiator of population change is assumed to be migration as a consequence of coal development, which in turn will come to affect population structure through consequent fertility and mortality.

Eight sets of projections have been made. First, the 1975 population was projected, given current age-sex characteristics operating in accordance with current age-specific fertility and mortality. Second, using a procedure followed in all subsequent projections, the effects of the Pearl Mine are added to the initial projection. In-migrants are assumed to be attracted to Sheridan County with the same age characteristics that characterized male residents aged 20-64 in 1975. Their wives and children are assumed to join them along with the wives and children of ancillary workers in the respective age-sex categories in Sheridan in 1975. Thus, the primary labor force, ancillary workers and all dependents are analytically distributed throughout the population in order to establish a structure from which projections may be made. Third, the effects of Scenario I mines are computed with the base population. Fourth, Pearl and Scenario I mines are projected. Fifth, Scenario I and II mines are projected. Sixth, Scenario I and II mines are projected along with the Pearl Mine. Seventh, Scenario I, II, and III mines are projected upon the base population. Eighth, Pearl Mine's projections are made along with the combined projections from Scenarios I, II, and III.

PEARL MINE [1] AND POTENTIAL GROWTH SCENARIOS [2]
FOR 1976-2000: Increases 1976-200

	1976	1980	1985	1990	1995	2000
Pearl Mine		111 134				
Scenario I (Low)						
West Decker	0					
Big Horn	0					
East Decker		115	---- 270			
North Decker Extension		50-70				
Ash Creek		21-45				
Scenario II (Probable)						
Scenario I						
Spring Creek		21	----- 253			
CX Ranch		10	----- 350			
Scenario III (Feasibly High)						
Scenario II						
Youngs Creek			29 - 350	----- 615		
Whitney		25				
Welch		50 100	----- 130			
PP & L Operation			25	----- 300		

1 Personal correspondence to Sandi Johnson, Montana Department of State Lands from A. T. Ireson, Mining Ventres, Shell Oil Co., September 30, 1977.

2 Approximate figures from Bernie Spiecman Population Update for Sheridan, Sheridan Area Planning Agency, May, 1977.

ASSUMPTIONS

For 1975 population figures let us assume they are 4% less than 1976 SAPA figures, as a reasonable starting point, since 17% increase had occurred1970-1976.

For each scenario, i.e,. Pearl, Scenario I, Scenario II, and Scenario III:

(1) Jobs are assumed to be filled by men in proportions similar to those found among the female population in Sheridan County ages 20-64.

(2) Each basic job effectively creates another job, also filled by men. Together, all employed men have 1.5 dependents, one-half of whom are wives and one-half of whom are children 0-19, equally divided among males and females. Wives are assumed to have the same age structure as 1975 Sheridan males 20-64. Children are assumed to have the same age structure as the 1975 population 0-19.

Assume an additional 1.5 dependents per full time mining employee, one-half of whom are wives of similar age. Assume an equal number of supportive and service personnel as miners, i.e., for each miner. Also assume that supportive and service personnel will, and have 1.5 dependents, one half of whom are wives of similar age. That is, each 150 mining employees will bring 225 dependents with them. Mine employees and dependents will require the services of 150 other persons, who also will bring 225 dependents with them. Thus, 150 mining jobs are assumed to generate 750 persons. This is a male-job generated assumption. It also has been assumed that the projected electric generating plant will produce 1000 MW. It will require 90 full time operating personnel who will average 1.5 dependents. It further is assumed that each operator will require an equal number of service and supportive personnel who also will average having 1.5 dependents. Thus, 130 generating plant positions are assumed to create residents. These assumptions are equivalent to a rather modest, multiplier effect of 5.0., distributed through the population structure according to their 1975 respective proportions for persons 20-64.

These are very moderate assumptions of growth. In contrast to some impact literature, the assumptions of demographic characteristic, numbers of workers and ancillary population generated by development and the extent of development, each of which the population projections indeed are quite moderate. For example, population projections for Big Horn County, given maximum coal development and power generation from that coal, indicate potential populations of 19,843 and 53,103, respectively for 1985 and 32,078 and 105,033, respectively for 2000. (Jobes, 1977) These figures are for higher than the maximum projections under the assumptions made for figures projected in this report.